MONTGOMERY WATSON

June 15, 1998

Mr. Michael Bellot, Remedial Project Manager
U.S. EPA, Region 5
Mail Code SR-6J
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Revised Natural Attenuation Study
Blackwell Forest Preserve Landfill
DuPage County, Illinois

Dear Mr. Bellot:

A natural attenuation study will be conducted at the Blackwell Forest Preserve Landfill site to evaluate the potential for intrinsic remediation (i.e., natural attenuation) to mitigate the organic contaminants of concern in the upper aquifer groundwater in the south portion of the site. Available site data provide evidence that natural attenuation is occurring and reducing organic contaminant concentrations in downgradient groundwater. This letter summarizes relevant site background, provides a review of the current evidence for natural attenuation, and describes the planned study.

SITE BACKGROUND

A network of wells has been established at the Blackwell Forest Preserve site to monitor a surficial glacial outwash aquifer and a deeper bedrock aquifer (Figures 1 and 2). These wells have been used to monitor groundwater quality periodically over the past 15 years. Beneath and downgradient of the landfill, the two aquifers are separated by a silty clay till that is up to five feet thick.

Historic monitoring data collected since 1983 and the results of the first round of a two-year quarterly groundwater monitoring program conducted in November 1997, indicate that groundwater in the outwash aquifer has been affected by low levels of organic contaminants in an area south of the landfill. The approximate area affected by volatile organic compounds (VOCs) in the outwash aquifer in November 1997 is indicated on Figure 1. The configuration of this area is generally similar to 1992. VOCs that were detected in November 1997 in the monitoring wells within the affected area include trichloroethene (TCE), cis-1,2-dichloroethene, and 1,1-dichloroethane. In general, fewer VOC compounds and lower concentrations were reported in 1997 as compared to 1992. Additional compounds reported in 1992 included benzene, 1,2-dichloropropane, chloroethane, 1,1,1-trichloroethane (TCA), perchloroethene (PCE), and vinyl chloride.

2100 Corporate Drive
Addison, Illinois
60101

Tel: 630 691 5000
Fax: 630 691 5133

Four semi-volatile organic compounds (SVOCs), phenol, pyrene, bis(2-ethylhexyl)phthalate, and di-n-octylphthalate, were reported in some of the upper aquifer samples collected in 1992 and November 1997. Phthalates were only detected in a few samples. Since these compounds are common field and laboratory artifacts, and the occurrences do not correlate with the distributions of identified site-derived contaminants, these detections likely reflect field and/or laboratory contamination. Pyrene was only reported in one sample in 1992 at a low concentration of 1 µg/L; this detection was probably not representative of groundwater quality. Phenol was detected in many of the samples, particularly those collected in November 1997; however, these appear to be field artifacts.

Recently, a leachate collection system (LCS) was installed at the landfill to remove leachate and reduce the potential for leachate migration. Samples of leachate from the LCS were analyzed in December 1997, January 1998, and February 1998 for the analytical parameters summarized in Table 1. The analytical results show the presence of a generally different suite of VOCs when compared to downgradient groundwater. The VOCs detected in leachate include acetone, benzene, 2-butanone, chlorobenzene, 1,1-dichloroethane, cis-1,2-dichloroethene, cis-1,2-dichloropropane, ethylbenzene, methylene chloride, 4-methyl-2-pentanone, TCE, toluene, and xylenes. It is possible that other VOCs are present but were not identified because detection levels are elevated due to the leachate matrix. Only two SVOCs, 3&4-methylphenol and phenol, were detected in leachate samples.

EVIDENCE FOR NATURAL ATTENUATION

Currently available site information indicates that natural attenuation is occurring in the upper aquifer. The principal evidence for natural attenuation includes:

- The extent of the affected area in the outwash aquifer has not changed significantly since 1992, so it is not expanding.

- The number and concentrations of VOCs in the affected area of the upper aquifer have generally decreased since 1992, suggesting that the source has lower concentrations now than earlier.

- The differences in the suites of VOCs in leachate and downgradient groundwater suggest that some organic compounds are degrading. The VOCs detected in leachate are all potentially mobile in groundwater but many are not detected downgradient from the landfill. It appears that the non-chlorinated VOCs (acetone, 2-butanone, 4-methyl-2-pentanone, ethylbenzene, toluene, xylenes and benzene) are being attenuated rapidly because they are not presently detected downgradient of the landfill, even in the closest monitoring wells.

- Chlorinated VOCs that are migrating at low concentrations from the landfill also appear to be degrading in groundwater, but at a slower rate than the non-chlorinated compounds. Degradation is indicated not only by generally lower concentrations in 1997 compared to 1992 and the apparently non-expanding configuration of the affected area during this five-year period, but also by the types of compounds identified. Most of the VOCs that have been detected in downgradient groundwater are typical degradation products of PCE, TCE and/or TCA solvents. For example, PCE and/or TCE commonly degrade via a sequence that may include 1,2-dichloroethene, vinyl chloride and/or chloroethane. The dominance of these typical degradation products as downgradient groundwater contaminants is strong evidence that natural attenuation processes are occurring.

In summary, the available site data provide evidence that natural attenuation is occurring in the outwash aquifer downgradient of the landfill. Moreover, the natural attenuation processes should prevent migration of contaminants to potential receptors at levels of concern. The following plan outlines a systematic program of sampling to provide additional supporting evidence of natural attenuation at the Blackwell Site.

NATURAL ATTENUATION STUDY

The study will include analyses of groundwater samples for additional natural attenuation parameters, the collection and analysis of soil samples from the outwash aquifer, and predictive modeling for the outwash aquifer. The additional parameters include electron acceptors, the presence of which support natural attenuation, and microbial counts which will allow for evaluation of potential toxicity in the aquifer. The sampling and analysis programs for groundwater and soil, and the planned scope of predictive modeling activities, are described in the following sections.

Groundwater

The natural attenuation study of the outwash aquifer will be conducted using 10 existing monitoring wells that form two transects located hydraulically downgradient of the landfill (Figure 3). Except for well G-128S, these wells are currently being sampled as part of the routine quarterly monitoring program. The parameters analyzed during the routine groundwater analyses are summarized in Table 2.

During the next routine quarterly sampling event, additional groundwater samples will be collected for natural attenuation parameters from seven of the existing outwash aquifer wells shown on Figure 3 (i.e., G-130, G-118S, G-129, G-128S, G-127, G-107S, and G-122), and from five of the existing deep aquifer wells shown on Figure 2 (i.e., G-132D, G-134, G-138, G-139, and G-140D). The additional samples will be analyzed for the additional natural attenuation parameters summarized in Table 2.

The analyses will be performed by First Environmental Laboratories, Inc., Naperville, Illinois and Keystone Laboratories, Newton, Iowa. First Environmental Laboratories is currently analyzing routine quarterly groundwater samples.

Details of the additional sampling procedures and analytical methods are summarized in Addendum No. 4 to the Field Sampling Plan, and in Addendum No. 7 to the Quality Assurance Project Plan.

Soil Sampling

Soil samples will be collected from within the outwash aquifer at three locations: within the affected area, at the downgradient edge of the affected area, and downgradient of the affected area. Specific sampling locations will be selected in the field based on the inferred position of the leading edge of the affected area and accessibility. Samples will be submitted to Keystone Laboratories, Newton, Iowa for analysis. U.S. EPA will be informed at least five days in advance of the collection of samples.

Chemical, physical and microbiological analyses will be performed on the soil samples submitted to the off-site laboratory. The chemical parameters are summarized in Table 2.

Details of the additional sampling procedures and analytical methods are summarized in Addendum No. 4 to the Field Sampling Plan, and in Addendum No. 7 to the Quality Assurance Project Plan.

MODELING

The conceptual model for the natural attenuation study will incorporate existing leachate analytical data, analytical data from the 10 existing outwash aquifer monitoring wells shown in Figure 3, as well as analytical data from Sand Pond. A surface water sample is scheduled to be collected from Sand Pond concurrently with the next round of quarterly groundwater sampling, and is to be analyzed for the same parameters as the quarterly groundwater samples shown in Table 2. The analytical data represents the following parts of the natural attenuation study:

	Transect 1	Transect 2
Upgradient*	G-122	Sand Pond
Source	landfill leachate	landfill leachate
Downgradient	G-130, G118S	G-126, G127, G107S
Further Downgradient	G129, G123, G128S, G117	---
Attenuated location	G-122	Sand Pond

* upgradient locations do not exist for the shallow aquifer, and these locations are considered a surrogate of background groundwater quality.

The natural attenuation modeling will consist of a site screening task followed by a verification task. Screening will consist of:

- Estimating groundwater flow characteristics using velocity, hydraulic conductivity, hydraulic gradient, porosity, and dispersivity;

- Determining the spatial extent and concentrations of the plume, compliance boundaries, exposure points, and source areas;

- Estimating biodegradation rates using literature sources;

- Estimating the rate of contaminant migration compared to the estimated rate of contaminant attenuation using the BIOSCREEN model. Values for dispersion, adsorption, biodegradation, source area information, and plume measurements will be used to calculate the distance the groundwater contamination is likely to migrate over a given time interval. Plume migration will be modeled assuming no degradation or attenuation is occurring, then degradation factors will be incorporated into the model and compared to that result. The modeling will indicate the extent of the plume; and

- Reviewing the hydrogeological parameters and potential exposure pathways, and fine tuning the site specific degradation rates using the regression analysis method of Buscheck and Alcantar ("Regression Techniques and Analytical Solutions to Demonstrate Intrinsic Bioremediation." In: *Intrinsic Bioremediation*, ed. R.E. Hinshee, J.T. Wilson, and D.C. Downey, 109-116. Columbus, OH: Battell Press, 1995).

Following screening, Montgomery Watson will conduct fate and transport modeling using BIOPLUME III to predict the future extent and concentration of the contaminant plume. The BIOPLUME III program is a two-dimensional, finite difference model for simulating the natural attenuation of organic contaminants in ground water due to the processes of advection, dispersion, sorption, and biodegradation. The model simulates aerobic and anaerobic contaminant degradation by sequential use of electron acceptors.

The fate and transport modeling is the verification step in the demonstration of natural attenuation, and will provide more specific information on plume dynamics. Calibration of the model and data input will follow the guidelines set forth in the Air Force Center of Environmental Excellence (AFCEE) Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater. First order source decay rate and establishment of boundary conditions will be critical in implementing the model.

REPORTING

After the study is completed, a report will be prepared for U.S. EPA. The report will summarize the study methods, present the field and laboratory results, and describe the predictive modeling performed. The report will also include an evaluation of the potential for natural attenuation to affect contaminants in groundwater in the south part of the site.

SCHEDULE

Collection of samples for additional analyses is planned to occur during the next round of routine quarterly groundwater sampling, which is scheduled for late June or early July 1998. Soil sampling and analysis are planned for the same time period. Following receipt of laboratory results, data analysis and modeling will require approximately one month to complete. On the basis of this projected schedule, a report is expected to be submitted to U.S. EPA during August 1998.

If you have questions or need more information on the natural attenuation study program, please contact us at (630) 691-5020.

Sincerely,
MONTGOMERY WATSON

Walter G. Buettner, P.E.
Supervising Engineer

Peter Vagt, Ph.D., CPG
Vice President

cc: Luba Finkelberg - U.S. EPA
Rick Lanham – Illinois Environmental Protection Agency (3 copies)
Jerry Hartwig – Forest Preserve District of DuPage County
Manoj Mishra – Tetra Tech EM, Inc.
Kurt Lindland, Assistant Regional Counsel – U.S. EPA
Dick Makarski – Chapman and Cutler

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Table 1
Leachate Parameters
Blackwell Landfill, DuPage County, Illinois

Laboratory Parameters - Quarterly Basis
Arsenic
Barium
Boron
Cadmium
Chromium (total)
copper
Cyanide
Iron (total)
Lead
Manganese
Mercury
Nickel
pH
Phenols
Selenium
Silver
Zinc
Biological Oxygen Demand (BOD)
Chemical Oxygen Demand (COD)
Oil & Grease
Ammonia (as N)
Total Dissolved Solids
Total Suspended Solids
[illegible] - Semi-Annually Basis
Volatile Organic Compounds
Acid Extractable Compounds
Base/Neutral Extractables Compounds
Pesticides

Table 2
Groundwater and Soil Parameters
Blackwell Landfill, DuPage County, Illinois

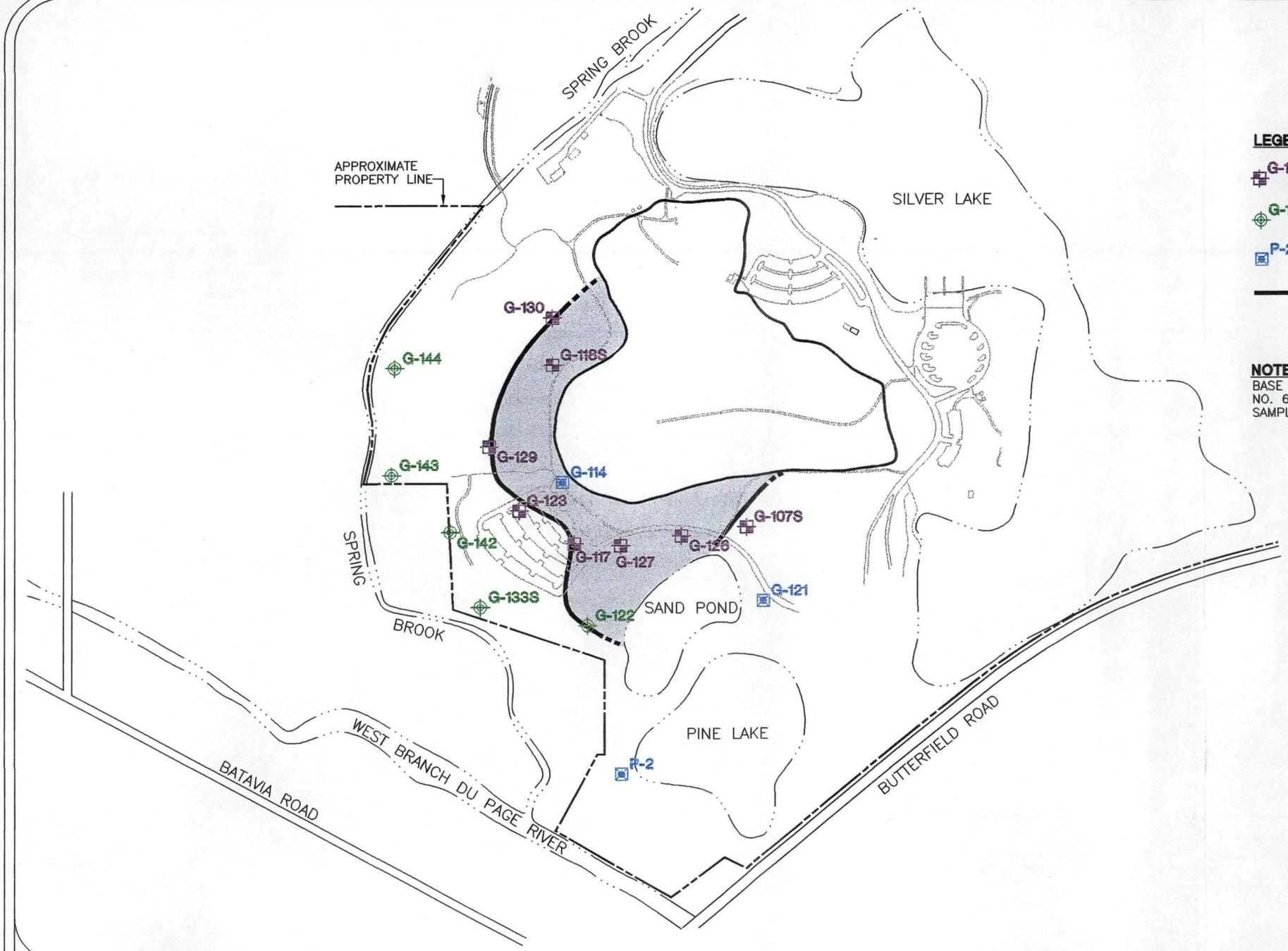
Routine Groundwater Parameters	
TCL volatile organic compounds	
TCL semivolatile organic compounds	
TAL metals & cyanide	
Chloride	
Sulfate	
Total Dissolved Solids (TDS)	
pH	Field Parameter
Temperature	Field Parameter
Conductivity	Field Parameter
Redox Potential	Field Parameter
DO	Field Parameter
Turbidity	Field Parameter

Natural Attenuation Parameters in Groundwater	
Total Organic Carbon (TOC)	
Biological Oxygen Demand (BOD)	
Nitrate-N	
Nitrite-N	
Sulfide	
Methane	
Ethane	
Ethene	
Alkalinity	Field Parameter
Ferrous iron (Iron II)	Field Parameter

Natural Attenuation Parameters in Soil	
Total Organic Carbon (TOC)	
Nitrate-N	
Sulfate	
Soil pH	
Total Aerobic Heterotrophs	
Aerobic Hydrocarbon Degraders	
Acridine Orange Counts	
Total solids	

TCL= Target Compound List
TAL = Target Analyte List

FIGURES



LEGEND

- G-126 — UPPER AQUIFER DETECTION WELLS
- G-122 — UPPER AQUIFER COMPLIANCE WELLS
- P-2 — UPPER AQUIFER WATER LEVEL WELLS
- APPROXIMATE DOWN GRADIENT MARGIN OF AREA AFFECTED BY VOCs (NOVEMBER, 1997)

NOTE

BASE MAP DEVELOPED FROM WARZYN INC. DRAWING NO. 6072100-B47, "GROUNDWATER MONITORING WELL SAMPLING LOCATION MAP", DATED JULY 28, 1994.

north

0 500 1000

SCALE IN FEET

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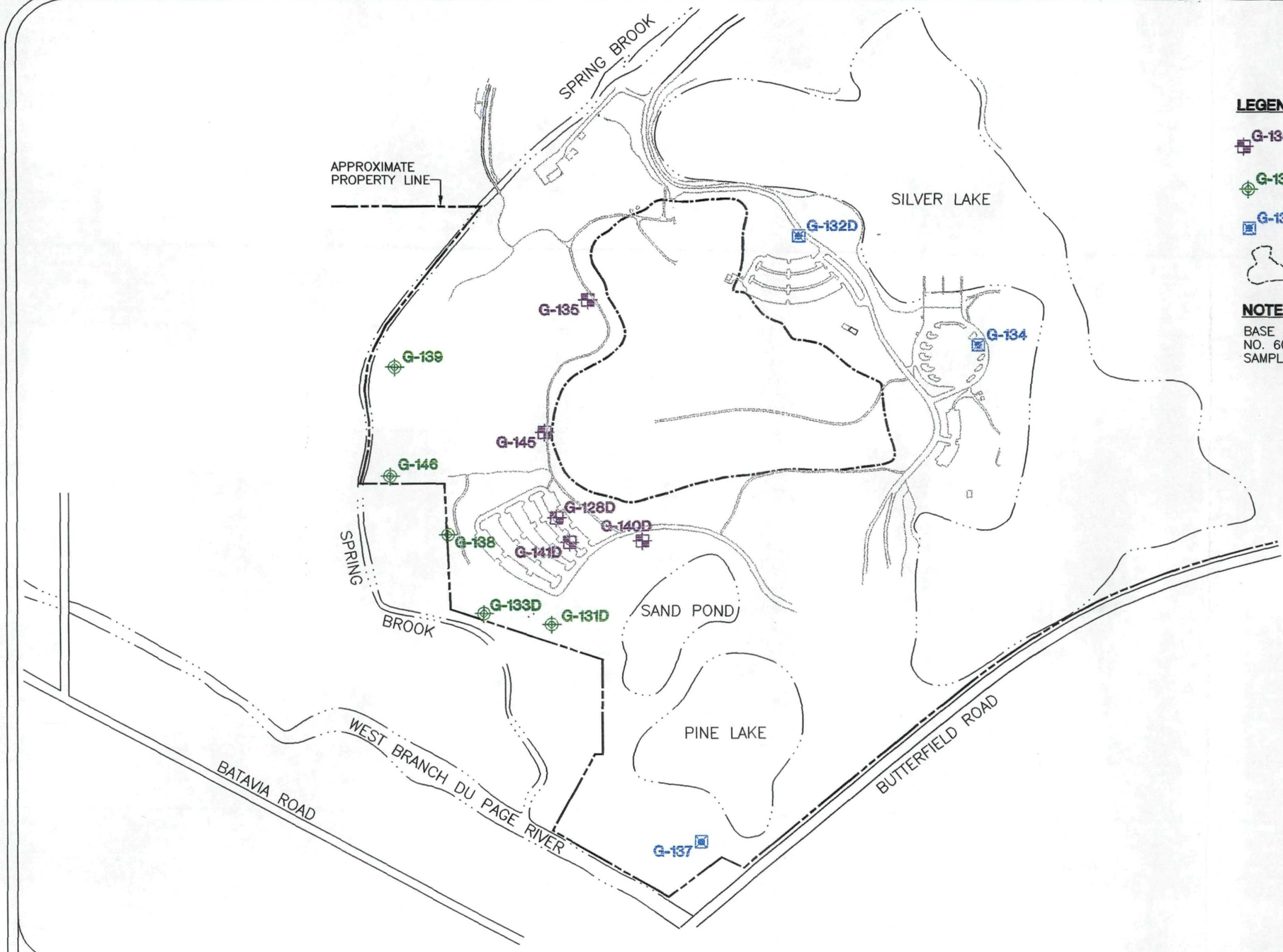
FIGURE 1

UPPER AQUIFER WELL AND PIEZOMETER LOCATIONS

BLACKWELL LANDFILL NPL SITE
DU PAGE COUNTY, ILLINOIS



LEGEND

- G-135 DEEP DETECTION WELLS
- G-139 DEEP COMPLIANCE WELLS
- G-132D DEEP WATER LEVEL WELLS
- LIMITS OF REFUSE

NOTE

BASE MAP DEVELOPED FROM WARZYN INC. DRAWING NO. 6072100-B47, "GROUNDWATER MONITORING WELL SAMPLING LOCATION MAP", DATED JULY 28, 1994.

north

0 500 1000

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FIGURE 2

BEDROCK AQUIFER WELL LOCATIONS

BLACKWELL LANDFILL NPL SITE
DU PAGE COUNTY, ILLINOIS

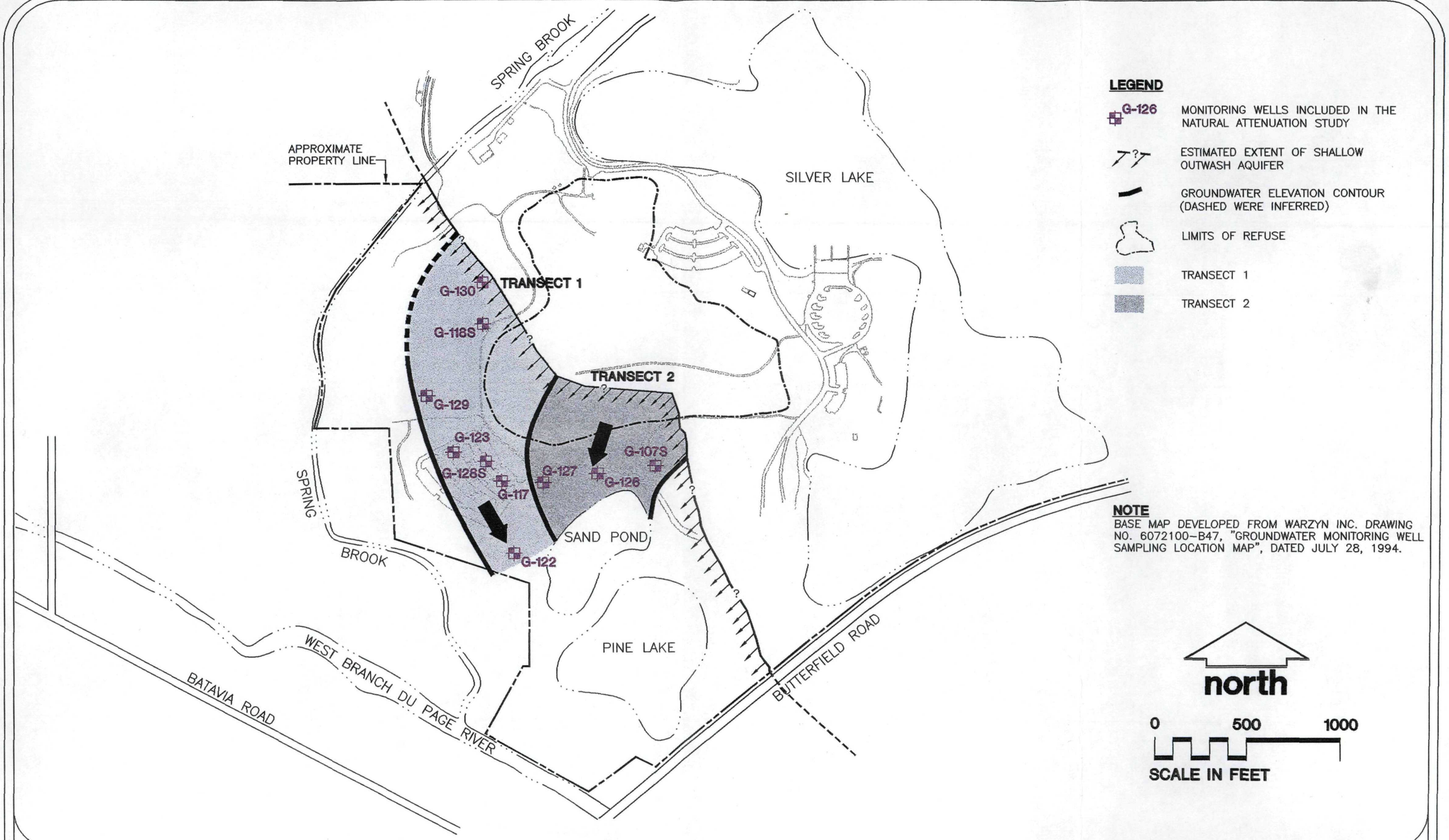

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FIGURE 3
TRANSECT LOCATION MAP
BLACKWELL LANDFILL NPL SITE
DU PAGE COUNTY, ILLINOIS

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